the
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THE MANUFACTURE OF SEMICONDUCTORS

By E. Joonnou
Eng. Sci. II

Today we live in a highly technalogical society. We have become dependant on it. Who doesn't own a digital clock or watch, a radia or Hi-fi? How many Engineering students have never programmed a computer? Used a DVM or Oscilloscope? All these wonders of Technology we toke for granted, but does anybody know haw they are made?

Most of todays electronics is based on Silicon, althaugh Germanium still finds some applications. Atoms of these semicaductors have four valence electrons, each bonded ta an adjacent atam in the crystal lattice. There are no free electrons ta carry charge.

A series of chemical steps is taken to increase the purity to the nine-9's level (99.9999999 %)

Thus pure silicon is not a gaad conductor. If however we add o small amaunt of an impurity such as phosphorous with five valence electrons, the extra electron plays no part in the bonds between atoms of the crystal, and thus readily becomes a mobile charge carrier. This process af adding an impurity is called doping, and a doped semiconductor with mobile electrons is called N-type material. If we instead dape with an element which has only three valence electrons, such as Boron, we get P-type material. Here instead af an extra electron, we have an absence of an electron, called a hole, a positive charge carrier that is also free to move about in the crystal. The designations N and P refer to the negative and positive polarities of the charge carriers. Diodes and transistors can then be farmed by PN and PNP or NPN sandwiches.

Texas Instruments production lab

The silicon used for semiconductor devices must be a single crystal of extreme purity. Raw silicon is first reduced from its oxide by high temperature electrolylis. A series af chemical steps is taken ta increase the purity to the nine-9's level (99.9999999%). This pure silicon is then melted (at 1420 degrees C) in an inert gas atmosphere. The right amaunt of doping impurities are added, and a large single crystal is grown from the melt by inserting a perfect seed crystal and slowly turning and withdrawing it. Singal crystals 3 to 4 inches in diameter and several feet long can be grown in this manner. The crystal is then ground down to a uniform standard diameter (either 3 inches or 100 mm), sliced into wafers ½ mm thick with a high speed diamond saw, the wafers ground flat on both sides, highly polished on one, and then can be sold to the integrated circuit manufacturers for abaut $10 a wafer. Most IC houses find it easier to buy their wafers rather than manufacture their own.

large photomask before reduction

The basic building block af todays integrated circuits is the transistar. A cross sectian through such a transistor is shown in Fig. 1. It is built by diffusion of the proper doping elements right into the silican substrate by a method which will be explained later. Most electron flow is down from the N-type collector, with a small amount of electrons being drawn out thraugh the base the keep the flow going. (The ratio of collector current ta base current is constant and is the current gain of the device.) This is called an NPN transistor because af the order af daping. The vertical scale on the diagram is exaggerated, so mast of the cantact between different regions is on a horizontal plane. The PN junction bet-

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APHRODISIAC

WIN!

Endocrinologists in Italy have found an experimental drug thot has abolished impotence in some men ond kindled sex drives in "wamen who never had an erotic feeling in their entire lives."

According to Andrea Genozzani of the University of Siena the drug, bromocryptine, can induce menstruation in women whose cycle has ceased. Another clinical trial, described by Domenico Fonzi in Chemical & Engineering News, demonstrated the drug's obility to increase sexual libido and restore spermatogenesis in men.

Bromocryptine acts by inhibiting secretion of the hormone prolactin in the pituitary; the drug's antidepressive effect may be due to its influence on the production of serotonin and dopamine, two major brain chemicals that partially regulate people's moods. Bromocryptine is now available in the U.S. on an experimentol basis.

Omni

DROPPING ACID

POISONOUS RAIN

by Albert Rosenfield

Acid rain — an odd-saunding, disquieting phrase to those of us who grew up thinking af rain as samething blessed and purifying that drops gently from the heavens. Yet naw, suddenly, acid rain—it might even be called poison rain—is being recagnized as a growing threat ta same forms af life on earth. Already, many a lake has been emptied of fish, and other species of land and water life are considered to be in similar danger. Soils have been damaged, and the growth of plants, crops, and forests retarded by acidic rainwater. The weathering and erosion of metal, stone buildings, and monuments have accelerated, and na ane can reassure us that human health is not also being threatened.

The increasing acidity of the rain is due mainly to the burning of fossil fuels, especially high-sulfur coal, now that the lawer-sulfur varieties are in short supply. In our current energy crunch, we ore planning to rely more ond more heavily on coal ond will probably increase its use manyfold over the next few decades. It seems that the raindrops falling aur heads will not grow gentler. In fact, says plant pathologist Leon S. Dochinger, of the U.S. Department of Agriculture, "Acid roin is perhaps the most serious environmental dilemma of this century."

One facet of the dilemma is that not much can be done about acid roin on a local scale. Take a superb recreational area such as New York's Adirondack Park. It was set aside legislatively to remain "forever wild"—and certainly nothing has been done within the park's extensive boundaries to pollute it. Yet a recent survey by Cornell biologist Carl L. Schofield of more than 200 of its high-altitude lakes revealed that more than half were dangerously acidic—and of these, many of them favorite fishing spots in former years, 90 per cent were now devoid of fish. Where did the acid come from? It came down in the roin and ron off in the snow. The offending pollutants might have originated almost anywhere to the west

cant. on page 3

Semiconductors

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ween substorte and collectar acts as a diode and anly passes current in one direction. Since no current can flaw into the substrate from a transistar even though the substrate itself is conductive, many transistars can be built side by side on the same substrate and operate without interfereing with each other.

A layer af silican dioxide about 0.1 microns thick is praduced aver the surface of the water by heating in an oxygen rich atmosphere af 1000 degrees C ar higher for about one haur.

The key to the aperation af the transistar is to make the base region very thin sa conduction can accur between emitter and collectar. It is because we don't want this type af canductian ta accur between the base and the substrate that the collectar regian is made sa large. Otherwise current from ane transistar could leak inta the substrate and ta another transistor. These large islands of material different fram the substrate are called isalatian islands.

In the manufacture of integrated circuits the first element ta be produced is the isolation islands. A layer af silicon diaxide abaut 0.1 microns thick is praduced aver the surface af the wafer by heating in an oxygen rich atmasphere at temperatures af 1000 degrees C ar higher far about ane haur. Time and tempeiature are precisely cantralled. A film af phataresist is depasited an the surface and an image af where the daping is ta take place is cantact printed an ta it. Ultra Violet light ar even X-rays ar electan beams are used to get the required resalutian. The hardened phataresist is then develaped in a salvent that washes away the unexpased phataresist. It is then further hardened by heating. The hardened phataresist protects the axide below it, while the rest is etched away with Hydroflauric Acid which attacks anly the oxide and nat the silican ar photoresist. The patterned oxide, with hole in it ta expase the silican belaw can naw be used as a mask to diffuse daping impuriies, in only the right places. The wafer is heated at abaut 1000 degrees C in an atmasphere containing the desired impurity. The doping aams will then diffuse down into the silicon to a depth dependant on time and temperature. Thus an N-type isolatian islond may be sund into a P-type substrate. The P impurities that were already there are outnumbered by the Ns, and the overall effect is that of an N-type material. By repeating the above phatoetching a N-diffusion procedure, but allowing less time for the impurities to difuse, thus getting a shorter penetration depth, one can sink a P-type channel into this isolation islond, and it turn sink another N into that. Thus one gets the transistor shawn in Fig. 1. Connections to other devices an the chip are made by again phataetching an axide layer to expase the desired cantact paints underneath, then plating the whale surface with aluminum and etching away that which you don't want.

The transistar is not the anly electranic device. Passive suppart elements such as resistars, capacitars, and inductars are also used, especially in radia gear. These range fram difficult ta impossible ta integrate. A resistar can be made by a narrow P channel in an N isolatian island. Its resistance is propartianal to its length and narrawness. Resistors cannat be made to precice tallerances, and large values are cumbersame. Capacitors can be farmed by a layer af aluminum separated by an oxide film from a layer of heavily doped semiconductar. This is a basic parallel plate capacitar, but the plates cannat be stacked vertically, or spaced as close as is passible with discrete capacitars. Only very small values of capacitars can be made in this manner. Inductars are clearly impossible. There is na way that a cail af many turns can be made an a flat wafer af silican. Because passive campanents are difficult ta praduce anbaard, pravisions are made ta supply them external ta the IC ar the circuit is designed ta da withaut them. Wherever passible transistars which are cheap and easy are used instead.

Packing densities are enarmaus, and are growing every yeor. An 8085 micraprocessar contains 6200 transistars an a chip measuring 4.17 by 5.64 mm. That's aver 250 devices per square millimeter. The larger memary chips cantain aver 32000 transistors. Bigger anes are an the drawing baards. Since the device dimensians are sa small, the smallest speck af dust on the wafer during the phatoetching process can spoil the device beneath. Therefar all manufacturing aperatians are carried out in a "clean-room" where the air is canstantly filtered and recirculated.

Abave I have described the manufacture of a single NPN transistar. Of course this single transistor is just one element of a larger circuit. All the rest of the elements in the circuit are praduced in the same manner at the same time, side by side on a single block af silican. Thus it is called a manalithic circuit, fram the ancient greek meaning "single stane." Many af these miniature circuits are manufactured side by side an the surface af a 100 mm dia. wafer. The circuits are then individually tested in place an the wafer using a fine probe that come down onto the chip and provides the power and signal connections to the outside world. If the chip is defective it is marked by a dot af ink, and the probe moved over to test the next chip. Since the chips are arranged in a regular rectangular array an the wafer this is a monotonous step-and-repeat operation ideally suited to computer control. Once all the chips on a wafer have been tested they are separated, individually packaged in the familiars plastic DIPs, and then tested once more before leaving the factory.

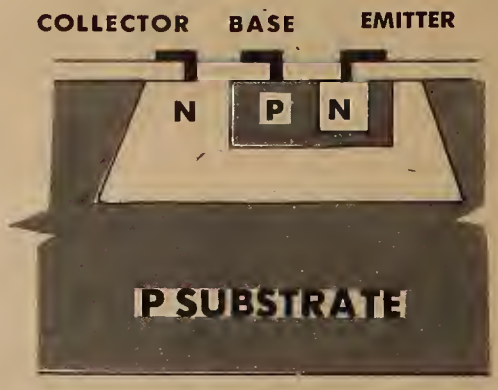


fig. 1

THE SUMMER JOB SCENE

OPPORTUNITIES OVERSEAS

INVEST YOURSELF IN A FOREIGN COMPANY

By HUBERT VOGT
3rd yr. Mechanical

Travelling is usually cited as an alternative ta working during the summer manths, but unknown ta most engineering students, there is a passibility that allaws you ta travel overseas and have a jab at the same time. Last year one hundred and twa Canadian students, fifteen from the U of T, spent their summer working abroad, as a result of a pragram run by a nan-profit arganization called IAEST. (The International Association far the Exchange of Students far Technical Experience). One af the fifteen students who were placed in jobs overseas by IAESTE was Larne Culter, now in faurth year chemical engineering.

Larne spent ten weeks last summer working for Shell Oil at their refinery in Fredericia, Danmark. His task there was ta find ways of reducing the amaunt of water used for cooling. At the end of his employ with Shell he wrote a repart outlining his recomendations far water canservation. Shell was very happy with his work and Lorne was satisfied with the technical content of his job.

This unique summer job/travel experience of Lorne's was all made possible by the work of IAESTE. Founded in London in 1948 with Canada becoming a member country in 1953, IAESTE has found a technical job in a foreign country for 841 Canadian students. As well, IAESTE has found approximately the same number of jobs for foreign exchange student here in Canada.

If a student in Canada is interested in a summer job abroad, he pays a $45 registration fee ta IAESTE. This maney, as well as matching funds from the Department of Labour, are used to pay far two programs which the Canadian branch runs. The first is a campaign ta secure job openings for foreign sudents which are then exchanged with other countries far job offers in their respective countries. The second program is an attempt to find suitable jab affers being exchanged by fareign countries for Canadian applicants.

By January, most of the first program is completed and Canadian job offers are exchanged for overseas job afers. This means that by February the matching af jabs with candidates can be campleted and successful applicants are notified. All that remains to finalize the job is a formal application ta the actual campany by the student. According to Lorne this is a rubber stamp procedure in mast cases. Thase students who are not placed by May are refunded $30 of their registratian fee.

The student must pay for his travel costs to and from the host country. Generally the salaries in foreign countries are low by Canadian standards, ($70 - $90 per week gross) and will only cover living expenses while overseas. As a result, having saved enough money for return airfare and next year's tuition and living expenses is a prerequisite.

An obvious question about such a program is that of language. Fortunately, since English is the universal technical languoge, out of IAESTE's 46 member countries only Austria, Belgium, Brazil, France, Germany, Portugal, and Switzerland require a working knowledge of their national tongue.

The main benefit of having a summer job in overseas according to Lorne is that you work during the week and on weekends you either taur on your own or ga on excursions organized by the host country's IAESTE branch. In his ten week stay, Lorne Culter saw many major cities in northern Europe as well as most of Danmark. This type of experience you cannot attach a manetary value ta.

Larne Cutler is quite happy with the way his summer job was arranged, with the way Shell treated him as an Engineer, and with the way Danmark accepted him as a visitor. He is quick to point out that "You don't do it for the money." You must have next year's finances secure. Irene Kerr, National Secretary of IAESTE Canada, agrees with him and adds, "If it weren't for the money aspect, there would be a flaod of students applying far the pragram."

The best summary is given by Cutler himself. "There are sa many people in engineering who want to travel and want to work. Well, now you can do both." If you are interested in IAESTE you can write to them at P.O. Box 1473, Kingston Ontario, K7L 5C7. As always it is best to apply early, ie: before December.

FAME AND MAYBE FORTUNE!

If you think others could benefit from hearing of your summer job story, if you a closet publicity freak, or if seeing your name in 11.03 point pica type gives you a thrill, then call me at 653-9073 and tell me all about it.

cont. *from page 1*

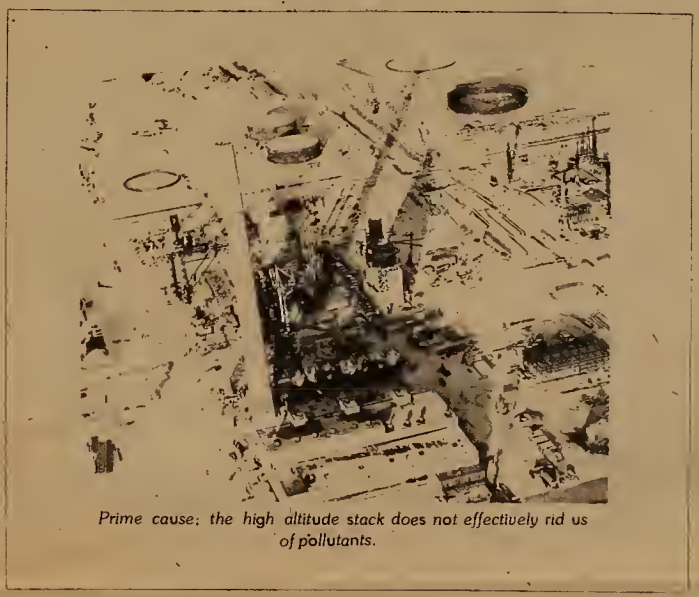
Poisonous Rain

and been carried aloft and eastward by prevailing winds. Among the prime suspects, in this case, are the huge ore smelters at Sudbury, Ontario.

Ironically, the increased acid-rain problem in many parts of the country is the direct result of antipollution measures taken in other areas. At Sudbury, as at so many other industrial sites, smokestacks have been raised high to carry sulfur oxides and other pollutants to the upper reaches of the atmosphere. Some substances, such as the fluorocarbons from aerosol sprays, do keep rising, perhaps to endanger the ozone layer. But most particles and gases are eventually washed down by the rain. By that time, the sulfur and nitrogen oxides, through a series of complex chemical processes, have been transformed into sulphuric and nitric acids. They come down where they happen to come down The mid-1950's, air pollution in England became so bad that planes often had a hard time landing at Heathrow Airport. Building the smokestacks higher resulted in a considerable clearing of the British air, but exacerbated the acid-rain problems of Scandinavia and Western Europe. The question we must ask is will people be willing to install expensive scrubbers, electrostatic precipitators, and other antipolluion devices to prevent pollution in other, distant places?

Right now, Canada's Ontario Hydro is planning to build an 800-megawatt, coal-fueled power plant only 45 miles north of Minnesota's Superior National Forest, including the Boundary Waters Canoe area. This region, with its thousands of lakes, is officially protected by Congress from any serious deterioration in its air quality. But the congressional restraining order may be as futile as King Canute forbidding the tide to come in, for the new Atikokan plant does not plan to install scrubbers in its high -rise smokestacks to reduce sulfur dioxide emissions—though it is supposed to burn low-sulfur coal mined in Canada. The U.S. State Department and the Environmental Protection Agency are pondering what, if anything, they should ask Canada to do about it.

The acidity of any liquid is measured by its pH number, on a scale from 1 to 14. A pH of 7 is neutral. A rising pH number means increasing alkalinity (saturated lime has a pH of 12.3), while a lower pH means higher acidity (pure sulfuric acid is 1.2). Important to remember is that a drop of one pH unit—say, from 6 to 5—indicates a *tenfold* increase in acidity; from 6 to 4 would be a hundredfold jump; from 6 to 3 a thousandfold. It should also be emphasized that "pure" rainwater is not neutral, but slightly acidic, with a pH of about 5.6 or 5.7. This is because the wate combines with carbon dioxide (the "exhalations" of green plants) to form a weak carbonic acid—which is a highly buffered solution, making the rain highly resistant to any further lowering of its pH. Some of the acids in the atmosphere would be there even without any human activity; they come from volcanic erupions, from forest fires, from various biological porcesses such as the action of bacteria on swamps. But the rain's buffering capacity would probably enable it to handle these natural contaminants. The overload, though, comes from the burning of our oil, coal, natural gas, and gasoline; these extra millions of tons of sulfur and nitrogen oxides (among other pollutants) ore more than rain clouds can hold up against.



Prime cause: the high altitude stack does not effectively rid us of pollutants.

> The offending pollutants might have originated anywhere...among the prime suspects...are the huge ore smelters at Sudbury

Acid rain has long been recognized as a serious problem in Norway and Sweden, whose mountainous soils—like those of the Adriondacks—are unable to neutralize acids. For a long time acid rain in the United States was perceived as being confined to the Northeast, where many lakes have a pH of below 5—low enough to kill off fish. The average pH of rain in Northeast has gone down to 4.1 over the last 25 to 30 years, representing a fortyfold increase in acidity. (Western Europe is roughly in the same fix.) In some especially acidic rains, both here and in Scandinavia, the pH has gone below 3. Environmentalists have recently realized that virtually all rainfall east of the Mississippi Rive has for some time been below the normal 5.6. Moreover, a survey in southern California showed that the mean pH of the rainfall in Pasadena for 1976 and 1977 was 3.9!

Such new revelations have spurred scientists to start organizing a nationwide acid-rain monitoring network. Among those cooperating will be the U.S. Department of Agriculture, the Tennessee Valley Authority, the Environmental Protection Agency, and the U.S. Geological Survey. Some 40 stations ae already in operation, and another 60 are scheduled to be functioning by 1982. They will coordinate their findings with stations in Canada and Europe. Meanwhile, the Scandinavian countries have been agitating for years to establish a global network—since acid rain is undoubtedly a global problem—and the United Nations has begun to take some steps in that direction. The idea is that if people understand that their pollutants are falling as acid rain on someone else, someone else's pollutants are falling as acid rain on them; so we had all better start cleaning up.

The seriousness of the acid-rain problem is still neither fully appreciated nor universally accepted. It is also true that much of the domage acid rain is alleged to have caused is based on minimal evidence. Let's examine what we know for sure.

Not really in dispute are the fish that have been killed. In many parts of Norway and Sweden, voluable trout and salmon runs have been wiped out. Canadian studies have revealed how the fish populations of so mony streams and lakes have been destroyed: The acid seldom kills fish directly; it mainly affects their procreative capacity so that the next generation simply fails to be born.

High acidity in the water lowers calcium levels in a prospective-mother fish to a point where she cannot produce eggs. Even when she does, both the eggs and frshly hatched larvae are especailly vulnerable to acid. Adult fish, too, are so stressed by it that their biochemistry is altered. In lakes where there is year-round acidity, the stress is chronic and debilitating. When the spring thaws set in, acids that have accumulated in the melting snow are released in sudden intensive bursts, causing the already-stressed fish to die in large numbers.

Some lakes are like war-ravaged villages where only the very young, the very old, and the very ill are left—and they are all particularly susceptible to further increments of acidity. Before long the fish population in the lake has fallen to zero. Though some species of fish succumb sooner than others, even the more resistant varieties are affected when the pH goes below 5. The Cornell group is actively working at developing strains of acid-resistant fish as one means of replenishing the depleted Adriondack lakes while waiting for the world beyond the Adriondacks to stop sending up pollutants for the rain to wash down.

There is less substantial evidence in regad to plants, farm crops, and forest lands. Expeiments at the Bookahven National Laboratory, Long Island, N.Y., have shown that brown spots (evidence of cell death) begin to appear on the leaves of some plants when the rainwater reaches a pH of 3.1. But it stands to reason that even at lower levels of acidity (higher pH) more subtle kinds of damage can occur.

Observations here and abroad suggest that the growth of many agricultural crops and forest lands has slowed significantly over recent years, an outcome often attributed to an increase in acid rain, though the connection remains to be proved. Some scientists believe that young plants are especially vulnerable. Just as there are critical periods in human fetal development when a drug like thalidomide or a virus like rubella can cause birth defects, so in a developing seedling can the presence of excess acid at crucial points interfere—sometimes disastrously—with normal growth.

As for acid rain's effects on man-made structures, it clearly accelerates the erosion of metal, painted wood, and various kinds of stone. Cornell's Gene Likens has photographs showing sandstone sculptures in Germany, which, though erected in 1702, showed no noiceable deterioration by 1908. By 1969, however, the erosion was substantial and worrisome. The same is true of buildings, monuments, and outdoor artworks the world over. Geologist K. Lal Gauri, of the University of Louisville, an expert in the restoration of stone, warns that structures like the Parthenon, the Colosseum, and the Taj Mahal—Already in various stages of decay—may disinegrate unless something is done to reverse the awful ravages of pollution.

Seldom sufficiently considered are some of the side effects of acid rain. For instance, Cornell's Carl Schofield was puzzled to find heavy trout mortality occurring in lokes whose acidity was much too low to account for what was happening. He and his colleagues, sleuthing the mystery, discovered that the reaction between the rain-borne nitric acid and the soil can set in motion a "second wave of destruction": the release of large quantities of aluminum into lakes and streams. "Because the poisoned runoff moves rapidly across the tops of the lakes in a relatively solid mass," Schofield explained, "fish can sometimes find refuge at the bottom of deeper lakes with a good oxygen supply. But in the shallower lakes the fish are caught in a deadly trap. They have the choice of dying from lack of oxygen at the bottom or from acids and aluminum at the top."

Or take the case of the spotted salamander, another Adirondack creature believed to be endangered by the acid rains. The salamander's diet consists of insect larvae, notably those of mosquitoes and midges; it in turn serves as food for other predators, such as birds, shrews, and foxes. If the spotted salamander were to vanish from a given area, we might witness a population explosion of

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WE HAVE A FEW QUESTIONS:

(1) Have you recently read any interesting engineering-related articles in magazines, journals, etc.?
(2) Are you writing n thesis?
(3) Do you know any engineers?
(4) Do you have any special engineering-related hobbies or interests?

If you answered "yes" to any of the above questions, we're counting on you to write for the Cannon.

The Cannon needs articles for all departments - from major illustrated technical reports to short Diversions. So if you have anything of interest ta other Engineers, let us know. The Cannon is your paper - your participation will guarantee its success.

The Cannon is distributed on Thursdays, whenever the Toike isn't. Deadline for copy is 5:00 PM Monday. Articles should be typed. The Cannon offices are on the third floor of the old Metro Library, across the aisle from the stores.

ENGINEERS!
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ATTENTION ALL COMMITTEE ORGANIZATION AND CLUB CHAIRMEN

The Cannon is a publication that is designed to keep all of our Engineering faculty informed as to the goings on around Campus. Since the vast majority of the student population in our faculty don't know the full extent of or even the purpose of various organizations, clubs and committees, the Cannon would be an ideal way to publicize the activities and events that will accur.

As well as this, all relevant committee and club internal affiars can be reported on within these pages.

Accordingly, anyone wishing to submit interesting articles relevant ta the above is welcome to, as this would be greatly appreciated by the entire student body.

All submissions should be put in the Cannon Mailbox no later than the Monday before publication.

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Associate Editors: Dana Williams, Rob Pupulin, Pete Rankin

Press: Eric Hosking
E. Joannou

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Faculty Council

GB 202 5PM Nov. 8

DIVERSIONS

by BRAMER KGNORT

double-talk: 1: language that appears to be earnest and meaningful but in fact is a mixture of sense and nonsense.

2: inflated, involved and often deliberately ambiguous language.
—Webster's New Collegiate Dictionary

Just about now in the first semester calendar most people in this faculty are faced with mid-term tests and along with those tests most people find that they are faced with their first major assignment in their non-technical elective. Last issue I suggested a way to pass time when the inspiration of write an essay was lacking. This issue I suggest a way to get the essay done and to make you non-tech. lecturer think, for once, about what you have written. Try double-talk.

Double-talk is a fabulous outlet for creative writers who have nothing to say. It allows them to express ideas that have no factual basis ar practicle application. What one form of double-talk does is it gives a writer license to use words with an inflated number of syllables and a restricted meaning all over his essay, even in the wrong places, without fear of recourse from any reader. It makes it possible to deviate from the norm and explore unfathomed venues of literary expression (read any book dealing with philosophy is you don't believe it). Use a little caution though, his form of double-talk, which corresponds to the second definition given in Webster, is dangerous in that you may accidently say something that you don't care to defend later on.

Using the first definition as a guide, it is more fun and less confusing to create prose that sounds something like what you may have wanted to say and yet that can never be taken in (and almost always out of) context if you are challanged on a point. The basic principle is to use alliteration and ta depend on people to impose meanings on words they perceive when they expect to perceive other words. For example, if you were to be verbally insulted and were to respond by saying, "I resemble that," in an offended tone, people would understand that you resented the insult even though they had never heard you speak the word resent. To use another example: One of the policemen in Joseph Wambuagh's *The Choirboys* liked to report an auto accident at a crossroad as a collusion at an interception tew paragraphs of this type of prose interjected with a real essay is sure to put your lecturer's mind in gear (don't worry about your mark though, because you can't get more than 70 anyway).

If you find that you are endowed with a natural talent for double-talk of the second kind then good for you. It can always be put to use writing highly technical articles for journals, theses, communist posters, or contributions to the Varsity. People able to create double-talk of the first kind are not as well published on campus, but I can suggest that if you have this extraordinary talent, contact the people who edit the Toike Dirt. They always need someone to write good filler to replace those crude jokes they always use.

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Poisonous Rain

mosquitoes and midges, with an accompanying diminution of those species that it turn, rely on the salamander as a major source of their food.

And as we talk about acid rain, we must not forget to ask: What else is coming down in the rain? Many scientists are not forgetting ta ask but they are not finding too many definitive answers. A host of pollutants is present in the atmosphere—particularly small quantities of tin, arsenic, lead, and mercury—and many are suspected of being washed down by the rain. Researchers at Colorado State University and the University of South Florida recently detected in rainfall for the fist time minute amounts of methyltin compounds which can, under certain conditions, be converted into even more toxic substances such as methylmercury. Scientists at the University of Georgia's Institute of Ecology, worried about the decline of the North American river otter, suspect environmental pollutants. They found in the otter alarmingly high concentrations of mercury which, they theorize, goes up with the burning of coal and comes down with the falling of rain.

Our Lakes and rivers are seriously threatned by acidic rainfall.

What does all this betide for human health? Most environmental-health scientists believe the pollutants we breathe in are more likely to harm us than those that rain down upon us. But even considering acidity alone, what are the effects of acid rain on human skin and hair? How low a pH level, and over what periods of exposure, is likely to be damaging? At what point does it make sense to start taking personal precautions? The questions are too new for dermatologists to have any ready answers. At this point, I think it would be foolish to panic at being caught in the rain. Just the same, if I were to wake up exuberant one rainy morning and feel an irresistble urge to do a long drawn-out singin'-in-the-rain number, a la Gene Kelly, in the driving downpour, I think I'd feel easier doing it with an umbrella.

Penquins Swim North

The Lure of the Ocean

The eleventh annual Canadian Congress of Engineering Students will be held in Halifax, Nova Scotia, January 3 through January 7, 1979.

The theme for this year's congress if "professionalism". Such topics as engineering attitudes, ethics, and social legal responsibilities will be discussed in lectures, workshops and seminars. From past experience, this conference is expected to be worthwhile for all students attending.

The professional Development Committee plans to send four or five delegates to the C.C.E.S. applications are envited from all undergraduate members of the Engineering Society. Preferer ce will be shown to students who have demonstrated an active interest in the affairs of the Eng. Soc. in the past, and to students who are willing to help in the preparations for this year's delegation. These preparations include a fund raising campaign to help defray the costs of transportation and registration. All interested students are asked to leave a note in the Professional Development mailbox (3rd floar, metro library)—outlining reasons for wishing to attend and listing qualifications such as Eng. Soc. experience—by November 10, 1978.

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